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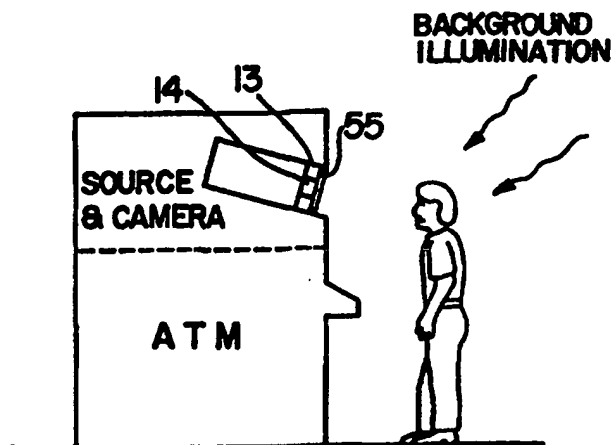
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(54) Title: **FILTERED AUXILIARY ILLUMINATION OF SURVEILLANCE AREA**

(57) Abstract

Infrared radiation from a light source (10) such as a laser diode illuminates the field of view of a surveillance camera (14). The amount of illumination is varied in intervals (fig. 3), which may for example, be about 3/4 of a second, by varying the power applied to the light source. The radiation may emanate from optical fibers (12) surrounding a camera lens (14), or through other ports. The power to the laser diode (10) may be altered in response to background light sensed by a photo cell (51). A filter (55) on the camera preferentially passes reflected illumination of the source while attenuating background illumination.



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FILTERED AUXILIARY ILLUMINATION OF SURVEILLANCE AREA

Technical Field

This invention relates to enhancing the illumination of surveillance fields of view for video and/or photographic recording of activity, such as in the vicinity of automatic teller machines (ATMs) and other areas.

Background Art

Recording of surveillance scenes is commonly used to deter criminal activity and to assist in apprehending the person responsible for the crime. Inside of banks and stores, video cameras have been quite successful in assisting the apprehension, and therefore useful as deterrents. On the other hand, recorded surveillance in the vicinity of automatic teller machines has been less successful. The scene monitored by a video camera at an ATM is typically poorly lit for video/photographic purposes. The field of interest is typically back lit and/or underexposed in that the sun or remote lights adequately illuminate the background scene, but not the face of an ATM user or an attacker near the ATM. In bright sunlight, for instance, the camera automatic gain control (AGC) may reduce sensitivity below that which provides an adequate definition of a face near the ATM.

25 Even with additional illumination, it frequently happens that the video or photographic record will be overexposed, or underexposed, despite the use of AGC and reasonable illumination.

The problem could be solved by bright spotlights shining on the area where the ATM user (or other subject) would normally be while operating the machine, but this will make customers extremely uncomfortable, and sun-blind the user to the extent of making it difficult to read the prompts and indicia while using the machine, and difficult to see an oncoming attacker or other threat.

Disclosure of Invention

Objects of the invention include provision of adequate illumination of the field of view of a surveillance recorder, and assurance of proper balance of illumination and sensitivity to yield a recognizable pattern of the recorded image of someone in the field of view of a surveillance recorder.

As used herein, the field of surveillance recording including video records (both digital and analog) and photographic records will be referred to, for convenience only, as video records. Thus, although the invention is described and claimed in terms of video cameras, recordings and playback, such terms will include photographic equivalents thereof.

15 According to the present invention, the field of view of a video camera utilized for security surveillance is illuminated with high intensity radiation, such as infrared radiation, thereby to illuminate objects and faces near the camera (such as a user or an attacker near
20an ATM) adequately to record the characteristics thereof despite the amount or variation in background illumination (such as from the sun and remote lighting).

In accordance with one embodiment, the relative intensity reflected from illumination of a surveillance
25field of view in comparison with background illumination is enhanced by a filter positioned in the field of view of the surveillance camera which attenuates a spectrum of radiation prevalent to background illumination and preferentially passes a spectrum of radiation from a
30source of auxiliary illumination.

The invention provides a much greater assurance of being able to recognize individuals in the field of a view of a video camera, both in daylight and at night, without unduly impairing the ability of subjects of the
35video record to see sufficiently to use an ATM machine and avoid threats in the area. The invention is extremely simple and capable of being implemented in a

variety of configurations to suit indoor and outdoor surveillance areas, in confined and open spaces, in existing as well as new installations.

Other objects, features and advantages of the present invention will become more apparent in the light of the following detailed description of exemplary embodiments thereof, as illustrated in the accompanying drawing.

Brief Description of the Drawings

Fig. 1 is a simplified schematic block diagram of an exemplary embodiment of the invention.

Fig. 2 is a front elevation view of a camera lens employing the invention, taken on the line 2-2 of Fig. 1.

Fig. 3 is a simplified illustration of the timing of the embodiment of Fig. 1.

Fig. 4 is a stylized illustration of the invention viewing a surveillance object at an ATM.

Best Mode for Carrying Out the Invention

Referring to Fig. 1, a light source 10, which may be a laser diode or one or more LEDs, illuminates a plurality of optical fibers 11 which may be split so as to feed additional optical fibers 12, to conduct the light from the source 10 and radiate it toward a surveillance field of view (to the right of Fig. 1), as seen in Fig. 4. The source 10 may be an infrared laser, such as an Opto Power Corp. OPC-A001. As seen in Fig. 2, the optical fibers 12 may terminate in an annulus 13 surrounding a lens 14 of a video camera. In such a case, the fibers may be selected from those readily available which have suitably shaped tips to provide about a 30° dispersion of radiation emanating from the tips thereof.

In accordance with the invention, the infrared laser diode 10 may be operated in a manner to provide varying intensity of illumination by providing different operating voltages to it through selectively operated

switches, such as a plurality of field effect transistor switches (FETs) 15-18, each applying a corresponding voltage from a tap 21-24 of a voltage divider which includes a plurality of resistors 27-32 between a suitable DC source 33 and ground.

An oscillator 36 drives a counter 37, the output of which on a plurality of lines 38 is decoded by a decode circuit 39 so as to provide signals on related lines 42-45 that, by successive operation of corresponding FETs 15-18 will provide steps of increasing voltage, which may be of 750 millisecond duration as illustrated in Fig. 3, or which may be adjusted to provide successive periods of varying illumination of any suitable length. The voltage steps may be selected with respect to the particular source 10 used so as to provide correct variation of illumination, which may (in the example herein) range from 0.05 watts to 0.3 watts, as seen in Fig. 3. The source of light 10 may be one or more LEDs, either infrared or otherwise, or any other suitable light source. In any case, the power steps should be chosen so as to provide, with the highest voltage, adequate illumination to record distinguishable features of a person in under the most dimly lit conditions of a particular surveillance field of view, and to provide, with the lowest voltage, an illumination sufficiently low so as to not to overexpose the same surveillance area at a time when it may be brightly lit.

If it is found to be useful, the embodiment may include the ability to shift the voltages by altering the voltage divider. For instance, the resistor 27 may be shorted out by a FET 48 when it receives a signal on a line 49, power conditioned by an amplifier 50 in response to a photo cell 51 detecting a given brightness level in the surveillance field of view. The photo cell 51 may be utilized to reduce the power provided to the infrared laser diode 10 during daylight; or it could be used to distinguish between the illumination outside of a gas

station in a period when the gas station is in operation and the lights are on from the period after the gas station is closed and most of the external lights are turned off. There are numerous other ways to alter the illumination, such as by having several ranges of alteration provided as a function of background lighting. If not useful, the variation in lighting provided by the apparatus 48-51 need not be utilized. Or, an increase in the power level may be achieved by shorting out resistor 10 at the upper end of the voltage divider, in a similar fashion.

The invention may of course be utilized with a greater or lesser number of steps than in the example given herein; it may utilize continuously ramping power, 15 by substituting a cyclic voltage ramp for the apparatus of Fig. 1; or it may utilize pulses of increasing steps synchronized with the camera vertical frame rate; and it may be altered in other respects, utilizing apparatus and techniques known to the art.

20 Instead of conducting radiation along the optical fibers 11, 12, a diode or other light source may be mounted directly in front of a lens or other port which overlooks the surveillance field of view.

The invention, by utilizing infrared, provides 25 adequate illumination without attracting attention to the source of the illumination, and without alarming or sunblinding customers in the surveillance field of view. The invention provides illumination where needed, to support video or photographic recording of the 30 surveillance field of view.

The invention may preferably be used with a real-time movie camera (video or photographic), but may also be used with a camera which records images in time-interspersed frames (e.g., two frames per second); the 35 term "surveillance camera" includes any such camera.

As shown in Fig. 4, the invention, in one embodiment, includes an infrared filter 55 in front of

the camera lens 14 to filter out visible illumination from background sources, and preferentially pass infrared illumination, thereby enhancing the desired image of an object in the field of view of a surveillance camera.

5 Thus, although the invention has been shown and described with respect to exemplary embodiments thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions and additions may be made therein and thereto, without
10 departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. Apparatus for illuminating the field of view of a surveillance camera, comprising:

an infrared light source;

optics for coupling radiation emanating from
5 said infrared light source to the field of view of a surveillance camera;

a source of power connected to said infrared light source; and

a filter positioned in said field of view of
10 said surveillance camera, whereby radiation of said field of view detected by said surveillance camera is filtered to exclude a selected illumination spectrum prevalent to background illumination of
15 said surveillance camera and to preferentially pass illumination in a spectrum including the infrared spectrum of said light source.

2. Apparatus for illuminating the field of view of a surveillance camera, comprising:

a source of radiation having a spectrum of
20 radiation different from a selected spectrum of radiation prevalent in background radiation within said field of view;

optics for coupling radiation emanating from said source to illuminate said field of view; and

25 a filter positioned in said field of view of said surveillance camera, whereby radiation of said field of view detected by said surveillance camera is filtered to exclude illumination in said selected spectrum prevalent to background
30 illumination of said surveillance camera and to preferentially pass illumination in a spectrum including the spectrum of said light source.

3. Apparatus according to claim 2 wherein said source is an infrared source, said filter is an infrared

35filter and wherein said selected spectrum of radiation
comprises wavelengths of visible light.

4. A surveillance recording system comprising:
a surveillance camera having a field of view;
a source of radiation for illuminating said
40 field of view, said source having a spectrum of
radiation different from prevalent background
radiation in said field of view;
a filter disposed on said camera, said filter
passing radiation in a spectrum including the
45 spectrum of radiation of said source, said filter
significantly attenuating a selected spectrum of
radiation prevalent in background radiation
illuminating said field of view.

5. A system according to claim 4 wherein said
50source is infrared and said selected spectrum is visible
light.

6. A method of recording images in a
surveillance field of view by means of a surveillance
camera which method includes:
55 illuminating said field of view with a source
of auxiliary illumination having a spectrum of
radiation different from prevalent background
radiation in said field of view; and
filtering the radiation entering said camera
60 to selectively pass radiation in a spectrum
including the spectrum of radiation of said source
while significantly attenuating a selected spectrum
of radiation prevalent in said background
radiation.

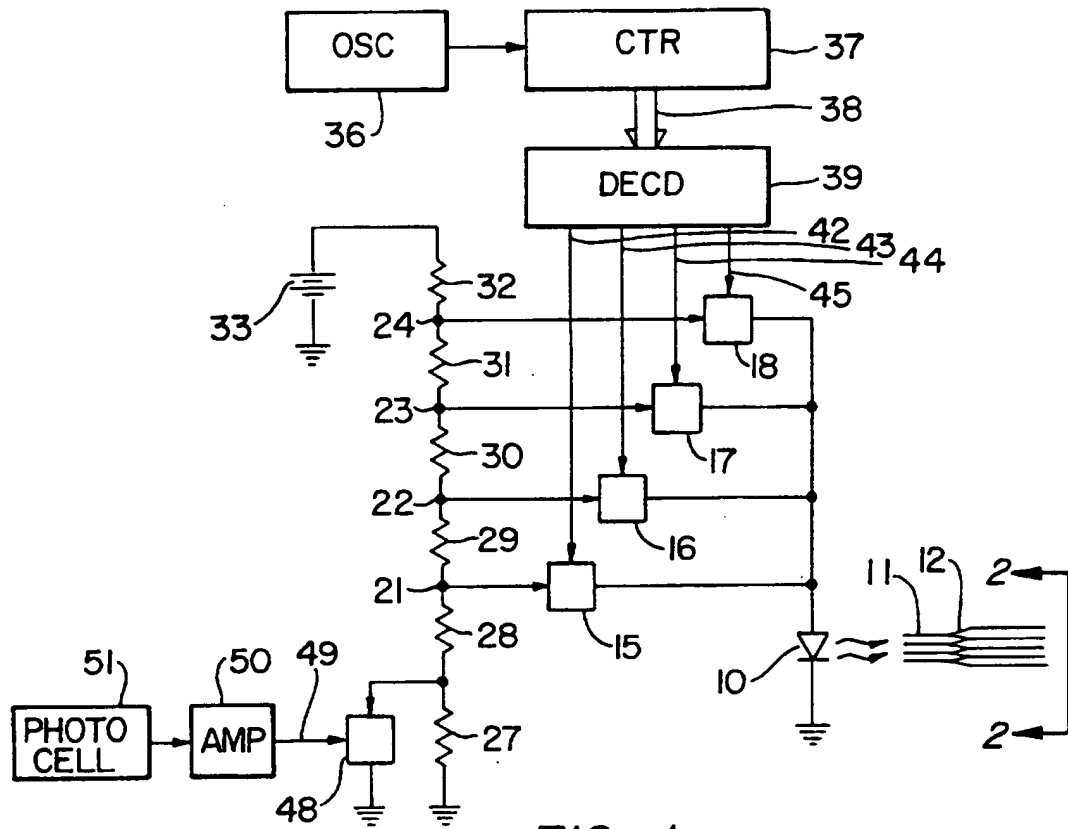


FIG. 1

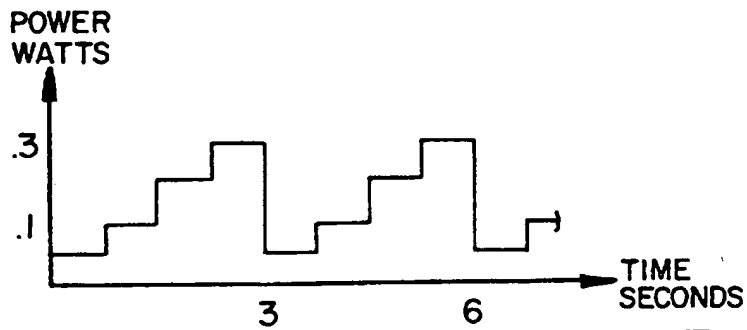


FIG. 3

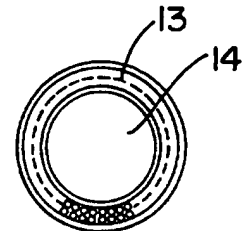


FIG. 2

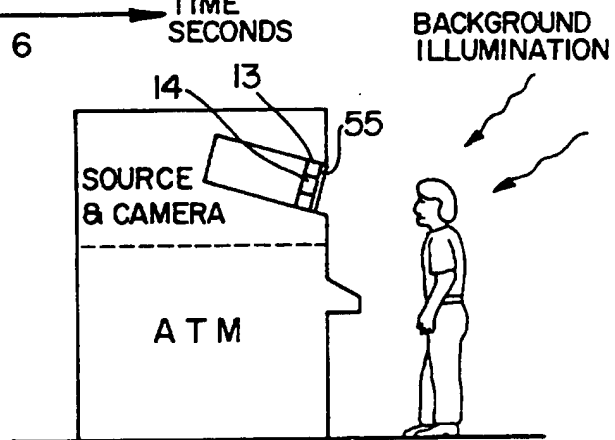


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/03332

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04N 7/18, 5/33

US CL :348/164, 143

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 348/164, 143, 150, 151, 152, 156, 370, 360, 361

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 3,816,654 (BRIGHTMAN) 11 JUNE 1974, see abstract.	1-6
X	US, A, 4,026,656 (KUSZ ET AL) 31 MAY 1977, see abstract.	1-6
X	US, A, 4,817,622 (PENNYPACKER ET AL) 04 APRIL 1989, see fig. 2.	1-6
Y	US, A, 4,843,461 (TATSUMI ET AL) 27 JUNE 1989, see figs. 1, 2, and 7.	1-6
Y	US, A, 5,153,420 (HACK ET AL) 06 OCTOBER 1992, see last sentence of abstract.	1-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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